

depends upon a number of parameters and variables such as the nominal circuit voltage, the installed transformer capacity, the number of transformation points, the load level, etc. In this article the application of a statistical procedure for the determination of the standard levels of energy losses in primary distribution circuits is proposed. The methodology is applied to a subset of 312 primary distribution circuits out of the total of 819 circuits of the electrical distribution network that serves the city of Caracas and its surroundings. The resultant standard upper and lower levels of energy losses are presented for the 15 different groups of circuits that were formed by the statistical procedure. These limits are used online for the identification of those distribution feeders with an operating level of energy losses out of the standard levels of its correspondent statistical group, as candidates for the application of energy losses reduction measures. The developed application software is presently running on-line at the distribution energy management system of the of C.A. La Electricidad de Caracas—AES Venezuela.

Keywords: Distribution circuits, energy losses, standards, statistics.

Preprint Order Number: PE-487PRS (04-2002)

Discussion Deadline: September 2002

Power System Planning and Implementation

Unreliability Cost Assessment of an Electric Power System Using Reliability Network Equivalent Approaches

Wang, P.; Billinton, R.; Goel, L.

Author Affiliation: Nanyang Technological University, Singapore; University of Saskatchewan, Saskatoon, Canada

Abstract: Unreliability cost evaluation of an entire power system provides a set of indices that can be used by a system planner to balance the investments in different segments of the system in order to provide acceptable load point reliability. This paper utilizes reliability network equivalent techniques to evaluate the customer load point unreliability cost indices caused by outages in different segments of the power system. The equivalent multistate generator (EMG), the equivalent multistate lateral section (EMLS), and the equivalent multistate series element (EMSE) are introduced. The percentage distribution of unreliability costs for system segments is determined to find the weak segments in the system. A test system is analyzed to illustrate the application of these techniques.

Keywords: Network equivalent, unreliability cost, reliability worth

Preprint Order Number: PE-374PRS (04-2002)

Discussion Deadline: September 2002

Performance Evaluation of Electric Distribution Utilities Based on Data Envelopment Analysis

Pahwa, A.; Feng, X.; Lubkeman, D.

Author Affiliation: Kansas State University, Manhattan, KS; ABB, Inc., Raleigh, NC

Abstract: In this paper, a method for benchmarking performance of electric distribution utilities based on data envelopment analysis (DEA) is presented. Basic theory of DEA is followed by case studies addressing performance analysis of the 50 largest (based on MWh sales) electric distribution utilities in the U.S. The results include performance efficiency, gaps in inputs and outputs of inefficient utilities, sensitivity-based classification of utilities, and a gap report. Also, peer-to-peer comparison of inefficient and efficient utilities is provided. Based on these results, inefficient utilities can develop strategic plan to improve performance.

Keywords: Strategic planning, decision making, data envelopment analysis, performance benchmarking, gap analysis.

Preprint Order Number: PE-005PRS (04-2002)

Discussion Deadline: September 2002

A Linear Programming Methodology for the Optimization of Electric Power Generation Schemes

Khodr, H.M.; Gomez, J.C.; Barinique, L.; Vivas, J.H.; Paiva, P.; Yusta, J.M.; Urdaneta, A.J.

Author Affiliation: Universidad Simon Bolivar; INELECTRA C.A.; Universidad de Zaragoza

Abstract: A mathematical model, based upon the application of a linear-integer programming algorithm, is presented for the optimum selection of independent electric power generation schemes in industrial power systems, taking into account reliability considerations. The problem is formulated as a mathematical programming problem, considering investment costs, fuel costs, operation and maintenance costs, power balance, maximum and minimum limits on the generated power of the units, as well as reliability considerations such as the unavailability of the generation scheme. These considerations include assumptions taken and simplifications performed in order to obtain an accurate enough linear model. The problem is solved using a conventional branch and bound algorithm for linear-integer programming, yielding to the optimum number of units, as well as the correspondent size and type. Results are presented for the application of the proposed methodology to a real case of an industrial power system. The technique is proved as a valuable tool for the planning engineer.

Keywords: Power generation planning, power generation economics, optimization methods.

Preprint Order Number: PE-020PRS (04-2002)

Discussion Deadline: September 2002

Wheeling of Power Under Deregulated Environment of Power System: A Bibliographical Survey

Sood, Y.R.; Padhy, N.P.; Gupta, H.O.

Author Affiliation: Indian Institute of Technology

Abstract: The power industry is moving rapidly from regulated conventional setups to a deregulated environment. There is an urgent need to keep a track of international experiences and activities taking place in this emerging field. This paper gives a bibliographical survey and general background of research and development in the field of power system wheeling under a deregulated environment based on over 170 published articles. Wheeling in general and the establishment of wheeling rate in particular are subjects of extensive debate today. This will be very useful for all countries, especially those developing countries that are moving towards the unbundling of electricity supply industry. The collected literature have been divided into many sections so that new researchers do not face any difficulty obtaining literature, particularly in the area of wheeling of power under deregulated environments.

Keywords: Wheeling, deregulation, congestion, privatization, independent power producers, nonutility generation, available transfer capability, transmission open access, unbundling, independent system operator.

Preprint Order Number: PE-109PRS (04-2002)

Discussion Deadline: September 2002

Application of Evolutionary Algorithms for the Planning of Urban Distribution Networks of Medium Voltage

Diaz-Dorado, E.; Cidras, J.; Miguez, E.

Author Affiliation: Universidade De Vigo

Abstract: An important issue in power distribution nowadays is the need to optimize medium-voltage networks serving urban areas. This paper shows how an evolutionary algorithm can be used as the basis for the type of efficient algorithm such optimization demands. The search for an optimal network solution will be restricted to a graph defined from the urban map, so each graph branch represents a trench. The solution space (networks) is assumed with "loop feeder circuits": networks with two electrical paths from the hv/mv substations to the customers. In the optimization process, the investment and loss load